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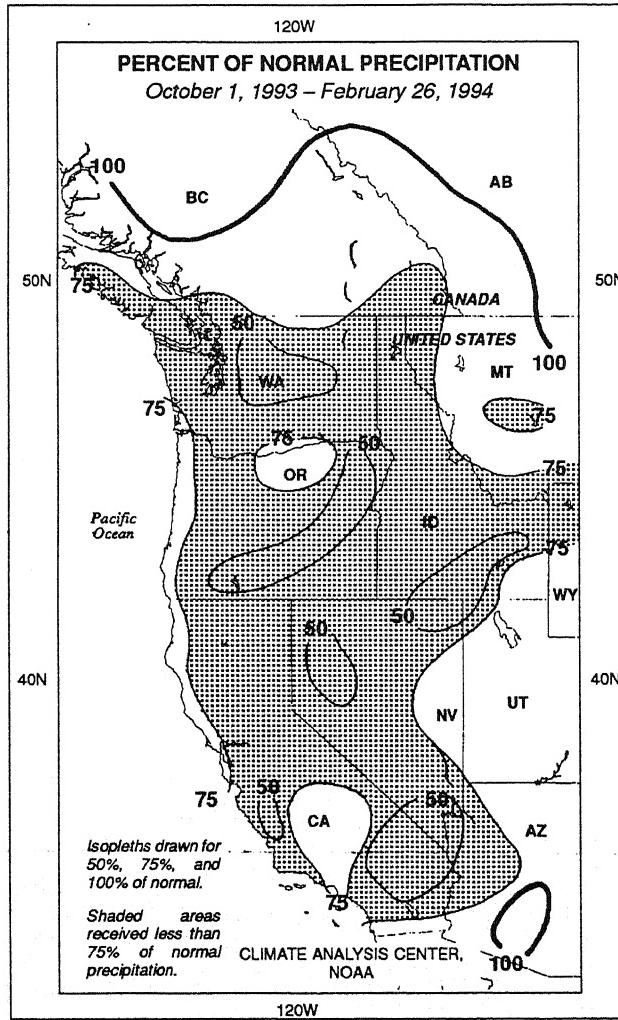
# **UPDATE ON THE 1993 – 1994 WET SEASON IN THE FAR WEST.**

# WEEKLY CLIMATE BULLETIN

No. 94/09

## Washington, DC

**March 2, 1994**



# **UNUSUALLY DRY WEATHER PREVAILS ACROSS THE FAR WEST DURING THE 1993 – 1994 WET SEASON.**

*During the past five months, below normal precipitation fell across most of the western United States. Since the hydrologic year began on October 1, 1993, extensive areas of the West received less than 75% of normal, with amounts below 50% of normal in portions of central Washington, south-central and eastern Oregon, southern Idaho and northeastern Nevada, western Nevada, extreme southern Nevada and southeastern California, and west-central California. Relatively heavy precipitation drenched the region in December, but well below normal amounts were reported in November and January. Surplus precipitation inundated most locations in February, but amounts were not sufficient to bring seasonal accumulations to near-normal values. Furthermore, heavy rains in and near Los Angeles, falling on fire-denuded hills, triggered some flash flooding and numerous mud slides. Mountain snowpack, which is vital for adequate water supplies during the long dry season (May – September), ranged from 50% to 80% of normal across most areas. For more details, see the Special Climate Summary on pages 5 through 10.*

UNITED STATES DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

## NATIONAL WEATHER SERVICE—NATIONAL METEOROLOGICAL CENTER

# CLIMATE ANALYSIS CENTER



# WEEKLY CLIMATE BULLETIN

This Bulletin is issued weekly by the Climate Analysis Center and is designed to indicate, in a brief concise format, current surface climatic conditions in the United States and around the world. The Bulletin contains:

- Highlights of major climatic events and anomalies.
- U.S. climatic conditions for the previous week.
- U.S. apparent temperatures (summer) or wind chill (winter).
- Global two-week temperature anomalies.
- Global four-week precipitation anomalies.
- Global monthly temperature and precipitation anomalies.
- Global three-month precipitation anomalies (once a month).
- Global three-month temperature anomalies (once a month).
- Global twelve-month precipitation anomalies (every three months).
- Global twelve-month temperature anomalies (every three months).
- Special climate summaries, explanations, etc. (as appropriate).

Most analyses contained in this Bulletin are based on preliminary, unchecked data received at the Climate Analysis Center via the Global Telecommunications System. Similar analyses based on final, checked data are likely to differ to some extent from those presented here.

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# GLOBAL CLIMATE HIGHLIGHTS

## MAJOR CLIMATIC EVENTS AND ANOMALIES AS OF FEBRUARY 26, 1994

### 1. Western United States:

#### **SOUTHERN CALIFORNIA DRIES OUT WHILE RAINS BRING RELIEF TO THE NORTHWEST.**

Little or no rain fell on southern California, providing good weather for clean-up operations after recent mudslides. In addition, light amounts were observed across much of the interior sections of the Far West, and six-week deficits ranged from 60 to 190 mm at a few locations. Meanwhile, up to 120 mm of precipitation eliminated short-term moisture shortages in western Washington, western Oregon, and northern California [DRY – Ended at 10 weeks].

### 2. Eastern North America:

#### **MORE WINTRY WEATHER.**

As much as 38 cm of snow fell on parts of the north-central and northeastern United States as winter storms caused scattered power outages and closed airports and schools, according to press reports. Most of the region received 20 to 60 mm of precipitation, with locally heavier totals approaching 160 mm from central Tennessee to eastern West Virginia, as unusually wet conditions developed across the eastern states [WET – 4 weeks]. Despite the wintry conditions, temperatures averaged only slightly below normal across most of the region [COLD – Ending at 10 weeks].

### 3. Northern Argentina:

#### **COOL SPELL ENDS.**

Near normal temperatures prevailed last week, ending the cool spell [COOL – Ended at 3 weeks].

### 4. Northern Scandinavia:

#### **STILL ABNORMALLY DRY.**

Little or no precipitation was reported in the northern parts of Norway, Sweden, and Finland as dry conditions persisted [DRY – 5 weeks].

### 5. Central and Southern Europe:

#### **DRY WEATHER BRINGS RELIEF.**

Little or no precipitation fell on much of the region, but isolated showers dumped 20 to 40 mm on parts of France, Switzerland, Belgium, the British Isles, the western Iberian Peninsula, central and southern Italy, and former Yugoslavia. Six-week moisture surpluses generally dropped below 50 mm; however, excesses of 120 to 200 mm remained at a few locations in the Alps [WET – Ended at 12 weeks]. Temperatures averaged up to 6°C above normal, abruptly ending unusually cool weather across much of the continent [COLD – Ended at 2 weeks].

### 6. Southeastern Africa:

#### **DRY CONDITIONS SPREAD ACROSS REGION.**

Although isolated showers dumped up to 120 mm of rain on some locations, most of the region received less than 30 mm. Scattered six-week moisture surpluses of 100 to 300 mm were reported in eastern South Africa [WET – Ending at 12 weeks]. Farther north, six-week deficits of 100 to 250 mm prevailed across eastern Botswana, southern Zimbabwe, southern Mozambique, and northeastern South Africa [DRY – 7 weeks].

### 7. Western Indonesia:

#### **STILL VERY WET.**

Showers yielded 40 to 80 mm across the region, with scattered totals approaching 160 mm. Although precipitation amounts decreased last week, six-week moisture surpluses remained as high as 300 mm [WET – 14 weeks].

### 8. Cape York Peninsula, Australia:

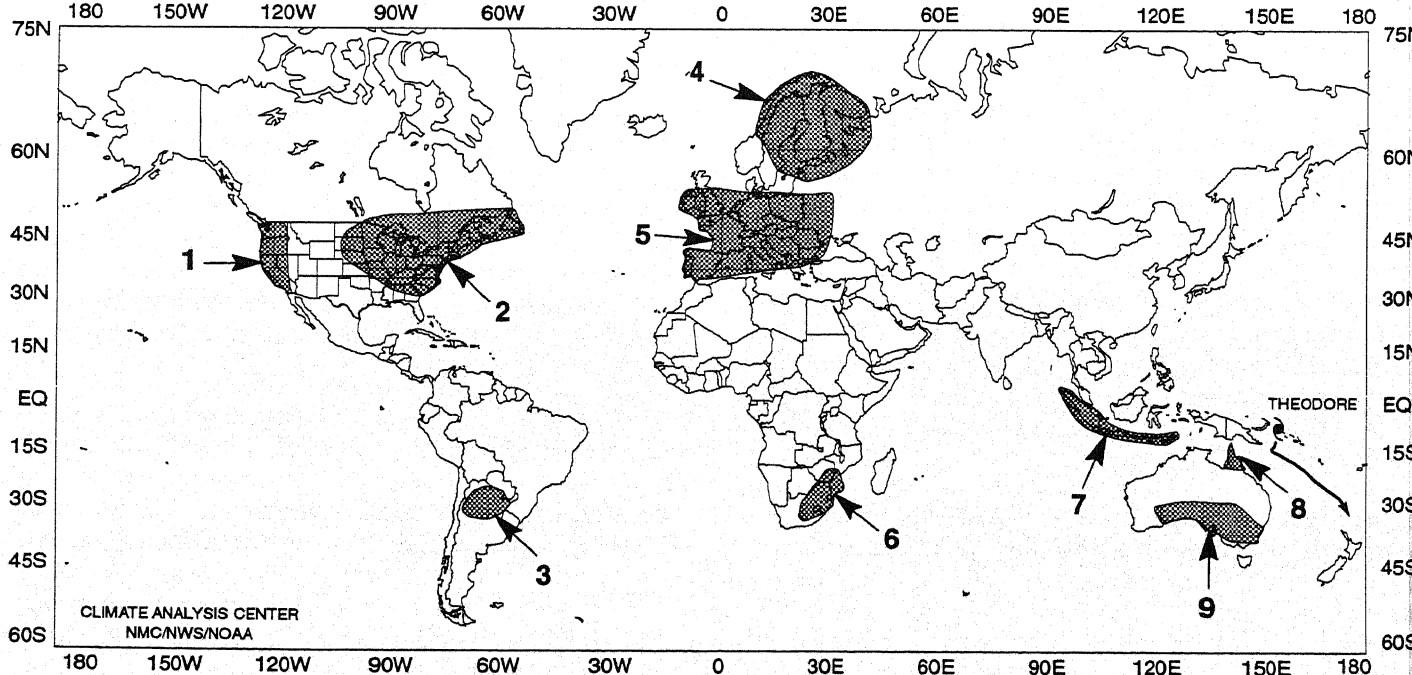
#### **STORMY WEATHER REPORTED.**

Torrential rains of 100 to 300 mm drenched the Cape York Peninsula during three of the last four weeks, and totals were well above normal since late January [WET – 4 weeks].

### 9. Southern Australia:

#### **WET WEATHER DEVELOPS.**

Up to 80 mm of rain inundated parts of South Australia last week, and scattered heavy precipitation during the last six weeks allowed moisture surpluses of up to 100 mm to cover south-central and southwestern Australia [WET – 6 weeks].



#### **EXPLANATION**

TEXT: Approximate duration of anomalies is in brackets. Precipitation amounts and temperature departures are this week's values.

MAP: Approximate locations of major anomalies and episodic events are shown. See other maps in this Bulletin for current two week temperature anomalies, four week precipitation anomalies, long-term anomalies, and other details.

# UNITED STATES WEEKLY CLIMATE HIGHLIGHTS

FOR THE WEEK OF FEBRUARY 20 - 26, 1994

A massive storm during the middle of the week spread severe weather and locally heavy rain from the southeastern Plains eastward to the southern Atlantic Coast, heavy and steady rain over the Tennessee Valley and mid-Atlantic, and ice and heavy snow from the central Plains and upper Mississippi Valley to the Northeast, closing schools and causing power outages and traffic accidents. On Tuesday, the storm buried parts of Nebraska under a foot of snow, and on Wednesday, up to 15 inches of snow covered southern Wisconsin and northern Illinois, shutting down Chicago's O'Hare Airport. Snow and ice also downed power lines in central Illinois on Wednesday as the entire city of Springfield lost electricity. Meanwhile tornadoes swept through the outskirts of Beeville, TX, wrecking at least nine mobile homes, according to press reports. On Thursday, near-whiteout conditions caused a 27 car pile-up that left four people dead in south-central Pennsylvania. During the latter part of the week, a second major storm sped out of Alberta, across the northern Plains, and to the northern Atlantic Coast, leaving up to a foot of snow around the Great Lakes and again closing Chicago's O'Hare Airport.

The week commenced with a strong cold front, reaching from lower Michigan to Oklahoma, pushing slowly to the southeast. Arctic air plunged southward into the northern and central Plains and upper Mississippi Valley behind the front while showers and thunderstorms soaked areas from the southeastern Plains to the eastern Great Lakes in the warm, moist air ahead of the front. Up to four inches of rain inundated parts of eastern Texas as rain and melting snow flooded streams across southern Michigan. On Monday, the northern part of the front spread precipitation eastward as it moved quickly into the Atlantic Ocean while the southern portion became stationary from the southern High Plains to the Carolina Coast. On Tuesday, a low pressure system developed along the front over the southern Plains and moved northeastward, generating high wind and widespread precipitation from the Great Plains eastward into the Ohio Valley and Southeast. To the east, our daily record high temperatures were set in the warm air ahead of the front along the Atlantic and eastern Gulf Coasts on Sunday and Monday. In the West, disturbances moving through a persistent broad upper-level trough of low pressure brought widespread locally heavy rain to the lower elevations and up to two feet of snow from the higher elevations of California's Coastal Ranges northeastward to the northern and central Rockies.

At mid-week, the center of the massive storm in the central United States tracked northeastward, generating precipitation over much of the eastern half of the country. Severe thunderstorms struck the southern tier of states from eastern Texas eastward to the Atlantic Coast with heavy rain, high wind, large hail, and tornadoes as heavy snow of up to 15 inches buried much of the region from the upper Mississippi and middle Missouri Valleys to the cen-

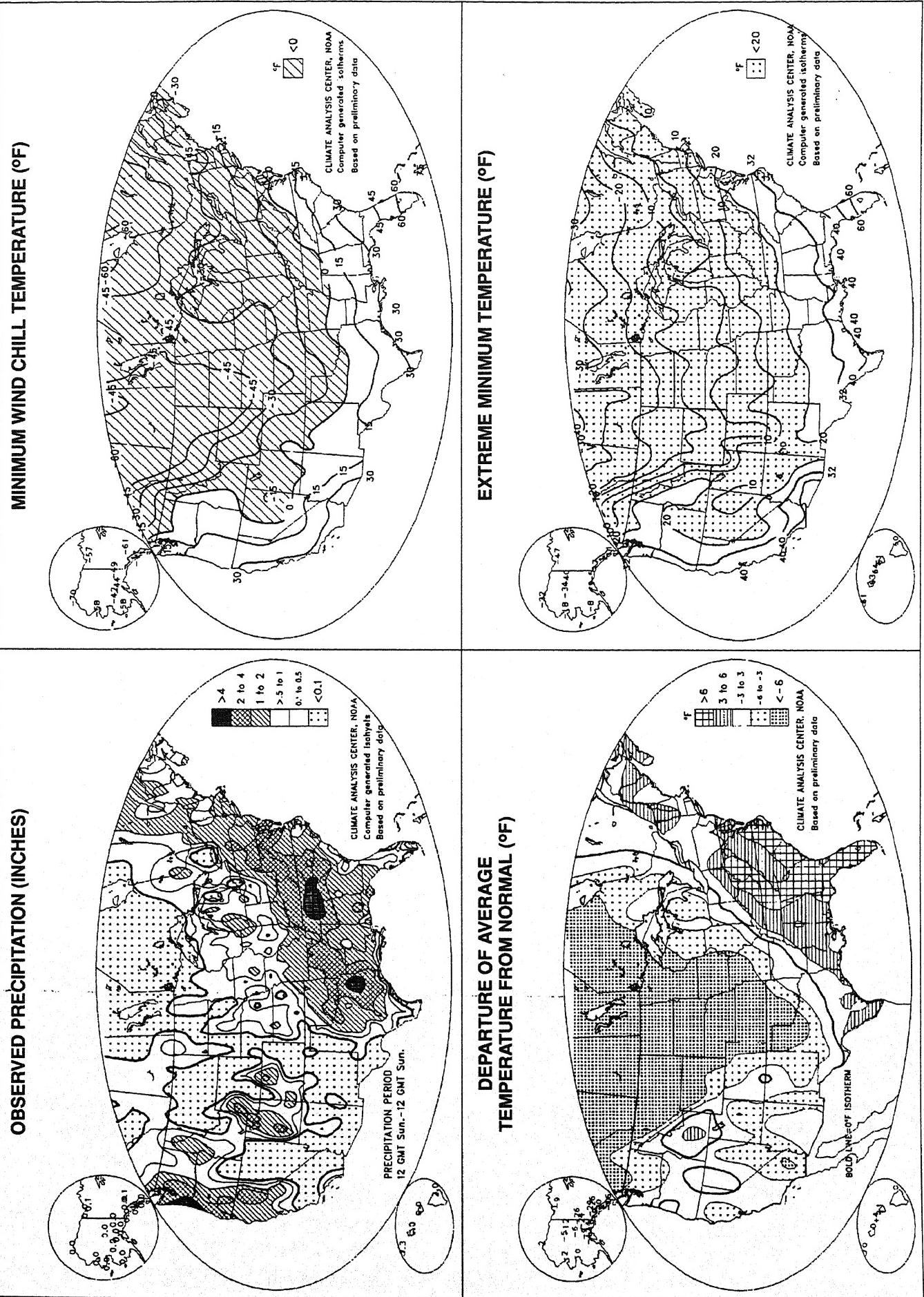
tral and northern Appalachians. On Thursday, heavy snow blanketed the Northeast and persistent rains soaked the mid-Atlantic and southern Atlantic Coast states before the large frontal system moved out to sea. On Friday, a fast moving low pressure system raced southeastward out of Alberta, across the upper Midwest, and into the Atlantic Ocean at week's end, creating a narrow band of blizzard conditions with strong winds and moderate to heavy snow. Farther west, two Pacific Ocean storms crossed the Northwest on Wednesday and Friday, respectively, accompanied by more precipitation, with up to a foot of snow in the higher elevations. As the week ended, more Arctic air plunged southward into the Plains and Mississippi Valley, where several daily record lows were established.

According to the River Forecast Centers, the heaviest weekly precipitation (from two to eight inches) fell on the Sierra Nevada Range of California, across western Washington and western Oregon, and from the southeastern Plains northeastward to the central and southern Appalachians. In addition, totals exceeded two inches at scattered locations along the northern California coast, across the central and northwestern Rockies, and in the remainders of the lower Mississippi Valley, the Southeast, the mid-Atlantic, and the Northeast. Light to moderate totals were measured in southern Alaska, eastern and western Hawaii, and much of the remainder of the contiguous United States. Little or no precipitation was reported in parts of the southern Rockies, the desert Southwest, the central and southern High Plains, and in the reminders of Alaska and Hawaii.

Above normal temperatures prevailed from southern Texas northeastward to the lower Great Lakes and the Northeast and eastward to the Atlantic Ocean, as well as portions of the northern Intermountain West and the western Great Basin, with weekly departures ranging from +5°F to +10°F observed in the Southeast and mid-Atlantic. In Alaska, abnormally mild weather covered the southwestern islands and northwestern portions, with weekly departures reaching +7°F at Nome. Temperatures averaged near to slightly above normal in Hawaii, with weekly departures of +2°F at Kahului.

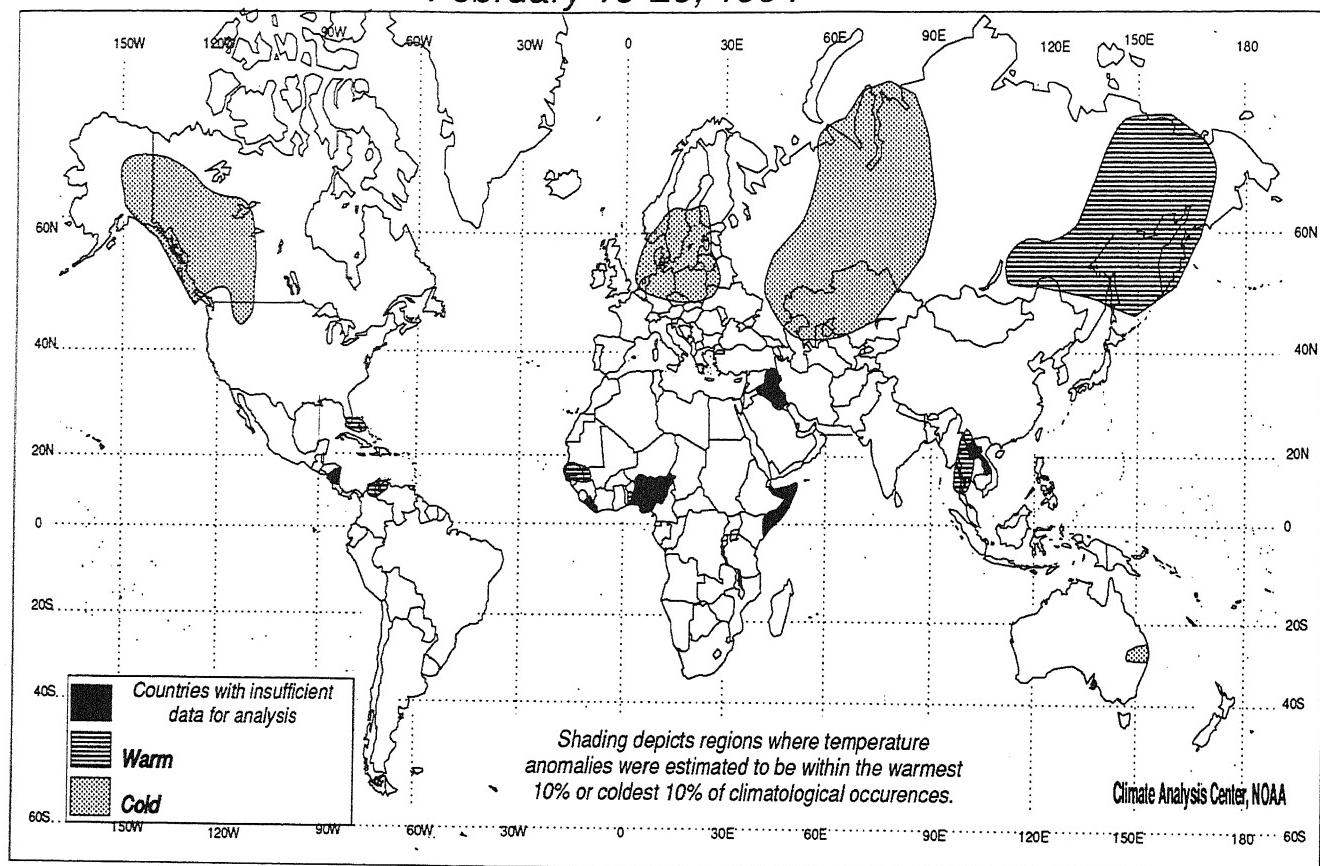
Abnormally cold conditions dominated the rest of the country as temperatures averaged more than 6°F below normal from the northern Rockies southeastward to the northern portions of the southern Plains and middle Mississippi Valley and eastward to the upper Great Lakes. Extremely cold conditions prevailed in the northern Rockies and northern Plains, with departures reading -28°F and wind chills below -45°F. Below normal temperatures also prevailed over the remainder of Alaska, with weekly departures of -25°F at Gulkana.

# UNITED STATES WEEKLY CLIMATE CONDITIONS (February 20 – 26, 1994)



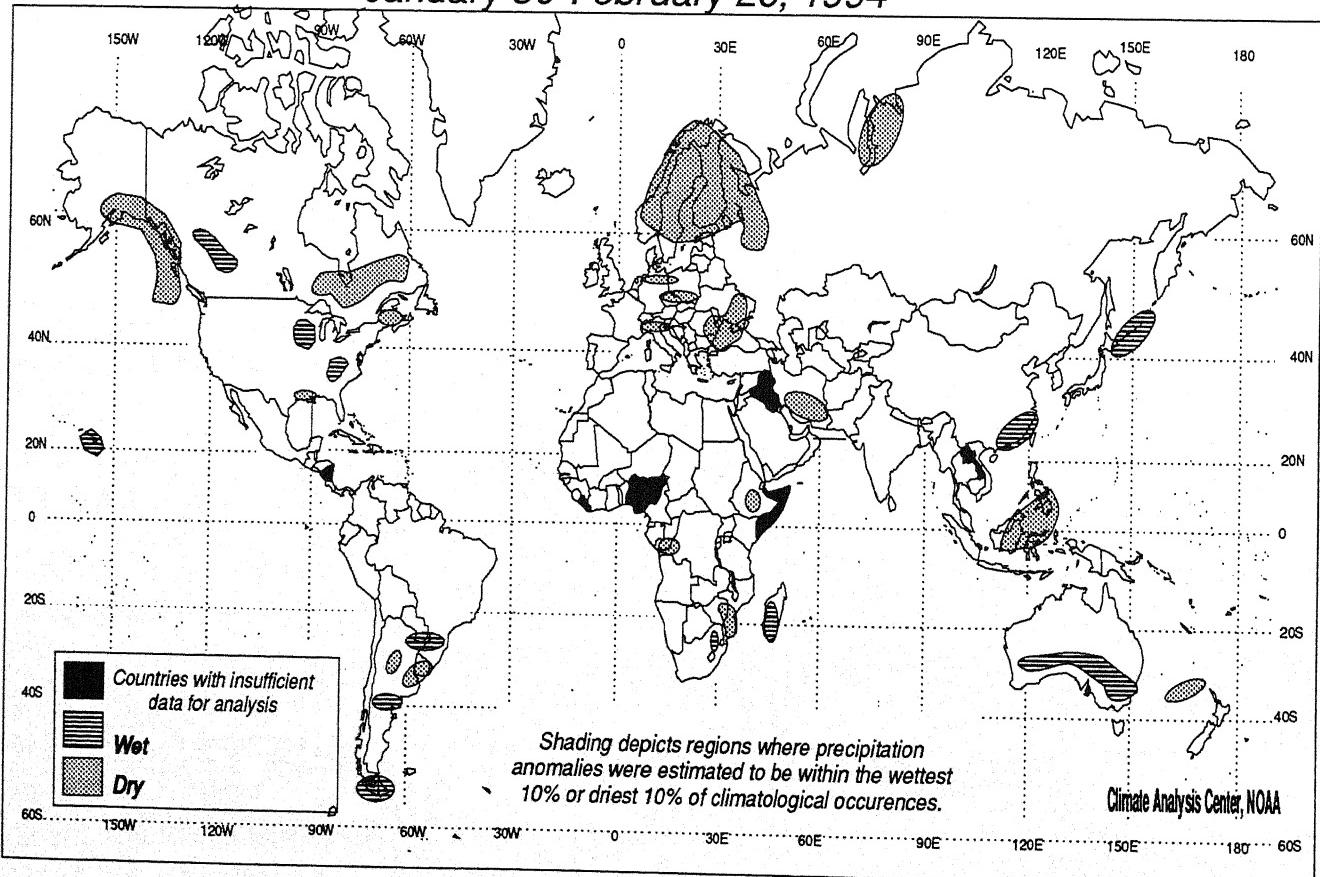
## TWO-WEEK GLOBAL TEMPERATURE ANOMALIES

February 13-26, 1994



## FOUR-WEEK GLOBAL PRECIPITATION ANOMALIES

January 30-February 26, 1994



# SPECIAL CLIMATE SUMMARY

*Climate Analysis Center, NMC  
National Weather Service, NOAA*

with input from

*Western Regional Climate Center*

and

*California Department of Water Resources*

## **UPDATE ON THE 1993-1994 WET SEASON IN THE FAR WEST**

Precipitation across western North America typically increases in autumn (following a dry summer), reaches a maximum near mid-winter, then declines as spring progresses. Since the vast majority of the region's precipitation falls during October – April, ample and timely precipitation (and the resultant development of a deep mountain snowpack) are vital to ensure adequate year-round water supplies. The six successive subnormal wet seasons observed from 1986–87 through 1991–92 dropped streamflows and reservoir storages to critically low levels through much of the Far West (particularly California), but an abnormally wet end to the 1991–92 wet season and persistently above-normal mountain snowfall through the 1992–93 season brought an end to the prolonged drought, although pockets of moisture shortages persisted.

Normally, precipitation remains relatively light through much of October, particularly in southern sections, and this was the case in 1993. Despite the rather small normals, moisture deficits were detected across northern California and western sections of Oregon and Washington. In addition, totals among the lowest 10% of the 1961 – 1990 climatological distribution were reported throughout British Columbia. These areas generally reported 25 – 150 mm of precipitation, with the larger values observed in the higher elevations of Washington's Cascades and the northern Sierra Nevadas. Farther south, little or no precipitation fell, as usual.

Amounts increased only slightly in November, getting the region's wet season off to a slow start. The Washington Cascades and extreme northwestern Oregon received 165 – 240 mm while 50 – 150 mm dampened the rest of the western halves of Washington and Oregon, west-central California, and the northern Sierras. Only 35 – 85 mm fell on northern and south-central California, and little or none was

observed through the southeastern quarter of the state. Totals across most of Washington and Oregon were among the driest 10% of the climatological distribution. Eureka, CA endured the driest October – November period since 1959, and several other locations (including Seattle and Quillayute, WA and Medford, OR) reported the driest November since 1976. Temperatures across the region averaged significantly below normal, particularly in Washington and Oregon, where monthly departures of  $-3^{\circ}\text{C}$  to  $-5^{\circ}\text{C}$  were recorded. This allowed a greater than normal proportion of the November precipitation to fall as snow, thus providing more mountain snowpack than would be expected given the exceptionally low precipitation amounts.

December brought an abrupt change in the weather pattern as heavy precipitation barraged the Far West throughout the first half of the month and again in the Northwest as the month drew to a close. Generally 175 – 320 mm drenched the western half of Washington, and up to 365 mm inundated the northwestern corner of Oregon. Farther south, between 65 and 255 mm fell across most of western Oregon while 125 – 305 mm were measured across the northern third of California and the central Sierras. Unfortunately, heavy precipitation remained north of southern California as only 50 – 100 mm of precipitation fell on the southern Sierras while 10 – 30 mm dampened the rest of the southeastern third of the state.

Except for early-January wetness in the Pacific Northwest, widespread subnormal precipitation was observed through most of the month across the entire western quarter of the country, with totals among the driest 10% of the 1961–1990 distribution in parts of northeastern California, northwestern Nevada, eastern Oregon, central Idaho, and western Montana. Between 125 and 240 mm fell on the Washington Cascades, southwestern Oregon, northern

California, and the extreme northern Sierra Nevadas. Amounts of 90 – 205 mm were recorded across the rest of western Washington and Oregon, 55 – 145 mm dampened central California and the central Sierras, 5 – 20 mm fell across southwestern California, and little or no rain was reported through southeastern California. Los Angeles recorded the driest January since 1976. On an area-wide basis, Arizona, Utah, Nevada, Colorado, Idaho, and Oregon all experienced one of the ten driest Januaries in 100 years of record, according to the National Climatic Data Center. In addition, an upper-level ridge kept temperatures abnormally high, further reducing the region's snowpack.

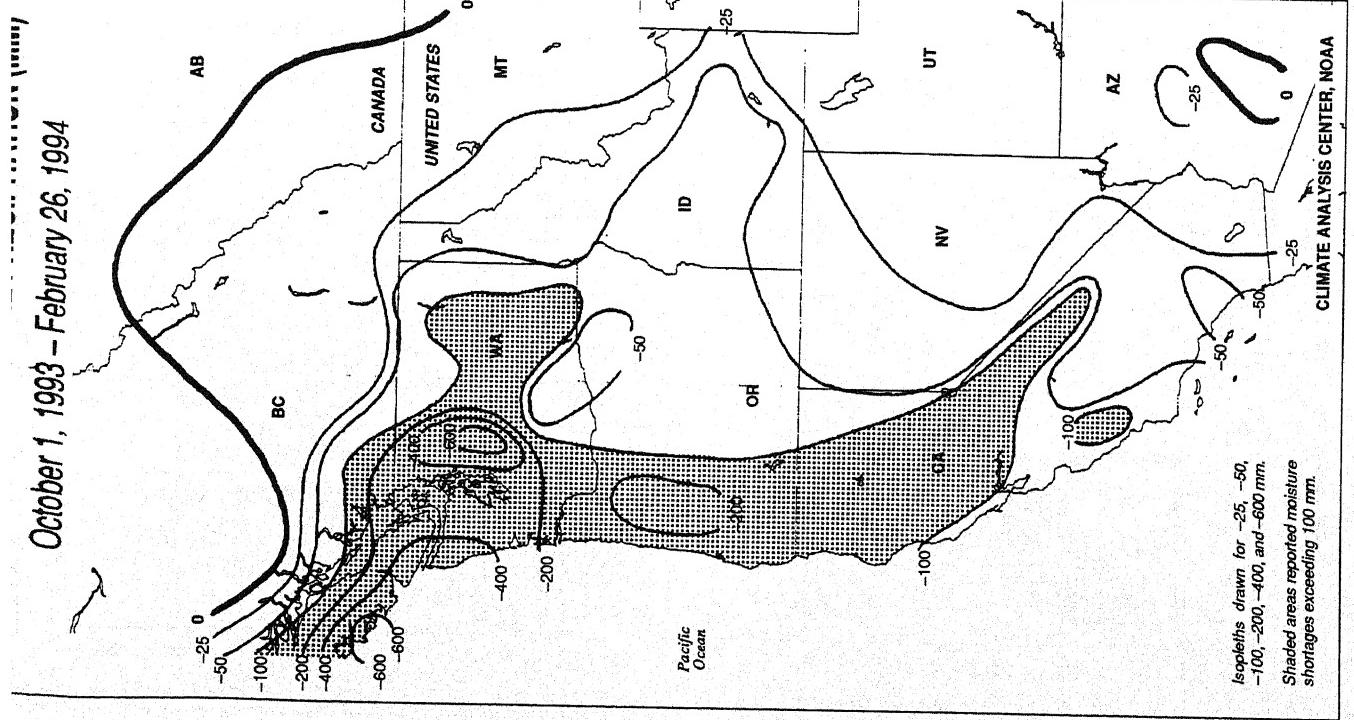
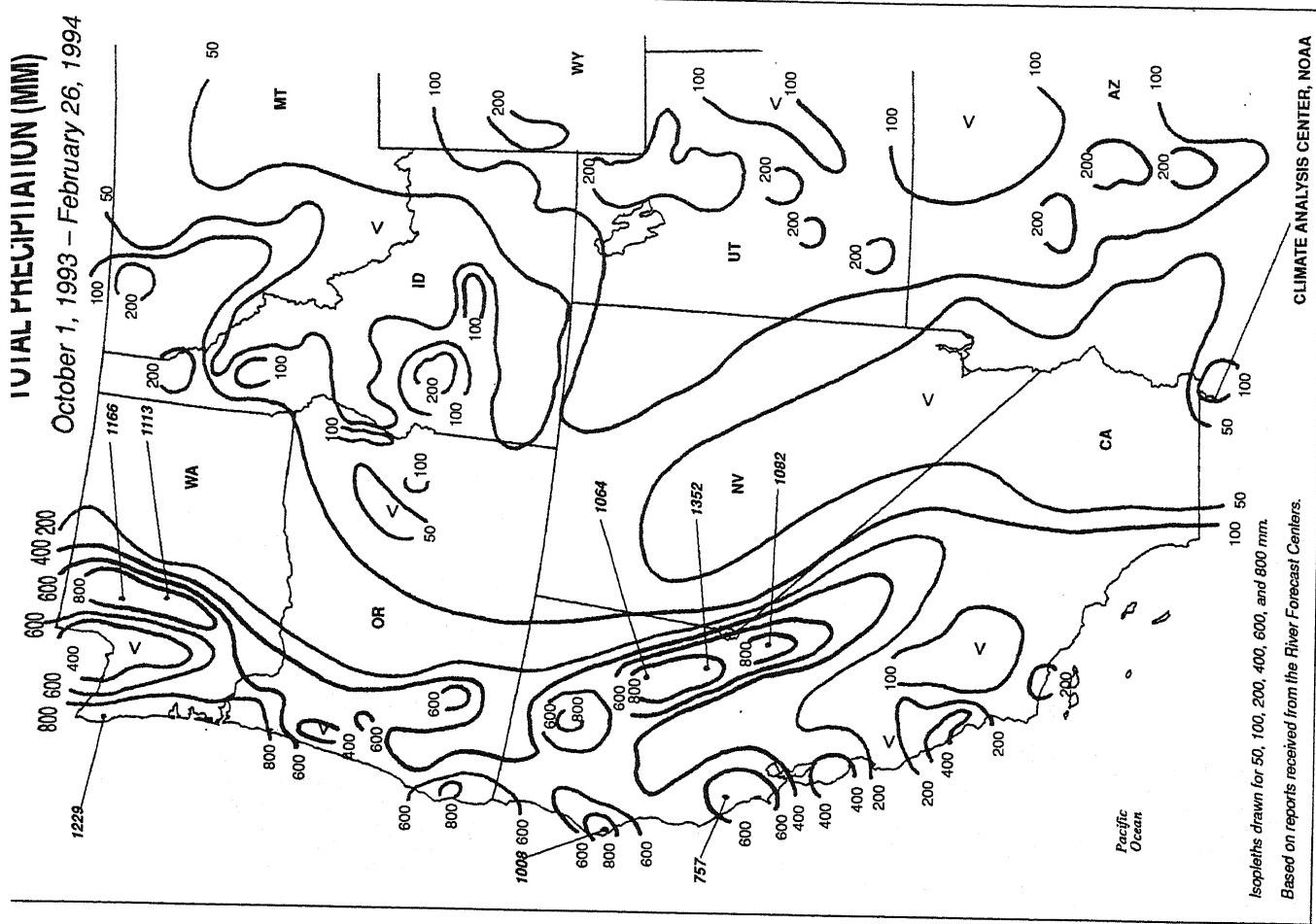
As in December, February brought an abrupt change in the weather pattern as a series of storms traversed the region, significantly improving what had been an exceptionally subnormal wet season. The higher elevations of the central and northern Sierras received 150 – 550 mm of precipitation while 150 – 400 mm soaked the western half of Washington. Quillayute, WA experienced the wettest February since 1983, and Eureka, CA reported the wettest such month in eight years. Between 120 and 320 mm fell on western Oregon, and 110 – 260 mm soaked the western tier of California from the Los Angeles area northward to the Oregon border. These rains improved, but did not completely alleviate, the season's moisture deficits; however, rain fell too heavily and too quickly on the fire-denuded hills in the Los Angeles area, engendering spotty flash floods and numerous mudslides. According to press reports, the Malibu area was particularly affected as several individuals were trapped in automobiles and deep mud flows swept into several mansions. The Pacific Coastal Highway was forced to close on two separate occasions because of flooding and mudslides.

For the wet season to date (October 1, 1993 – February 26, 1994), almost the entire western third of the country received subnormal precipitation, with large sections of southern California, northern and extreme southern Nevada, southern and eastern Oregon, southern Idaho, and central Washington reporting under half of typical totals despite February's above normal amounts (see front cover). Totals above 75% were restricted to the central and southern Sierras, portions of southwestern California, north-central Oregon, and the immediate coastline of central and northern California, Oregon, and extreme southwestern Washington. Shortfalls exceeding 100 mm covered most of the northern half of California, western Oregon, and much of Wash-

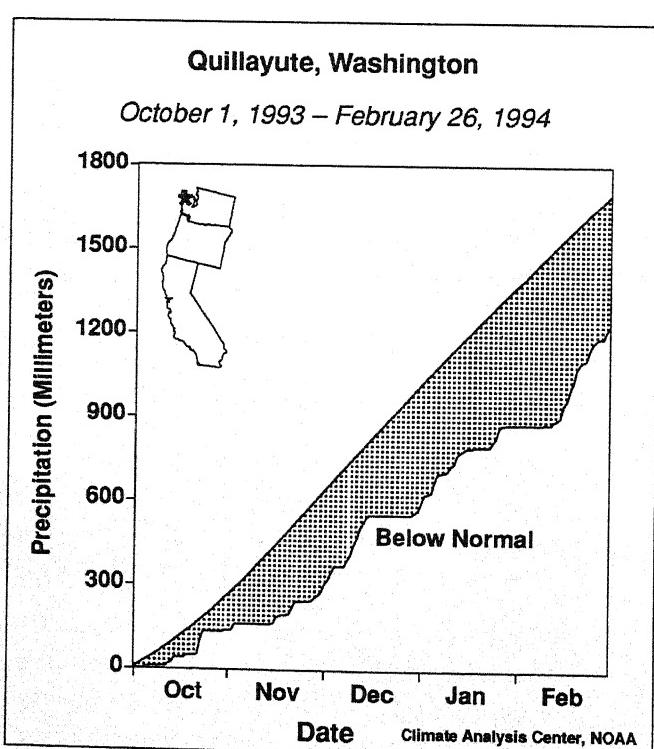
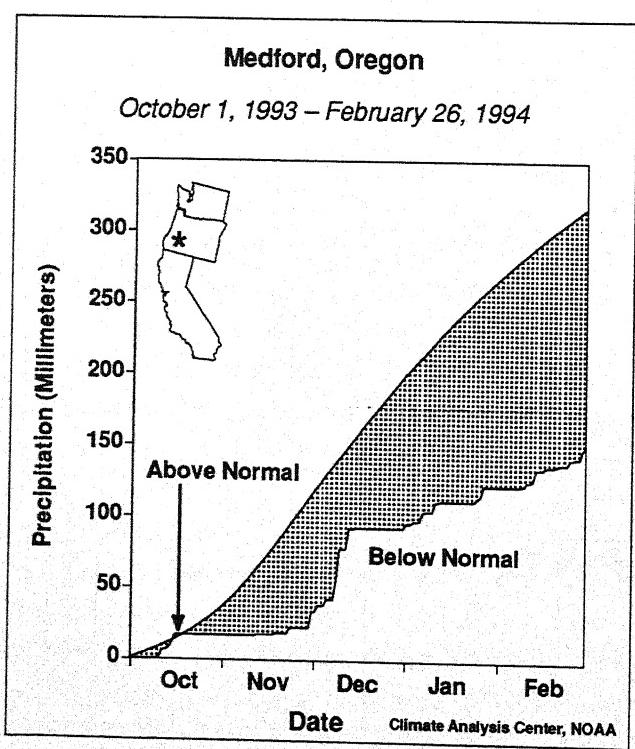
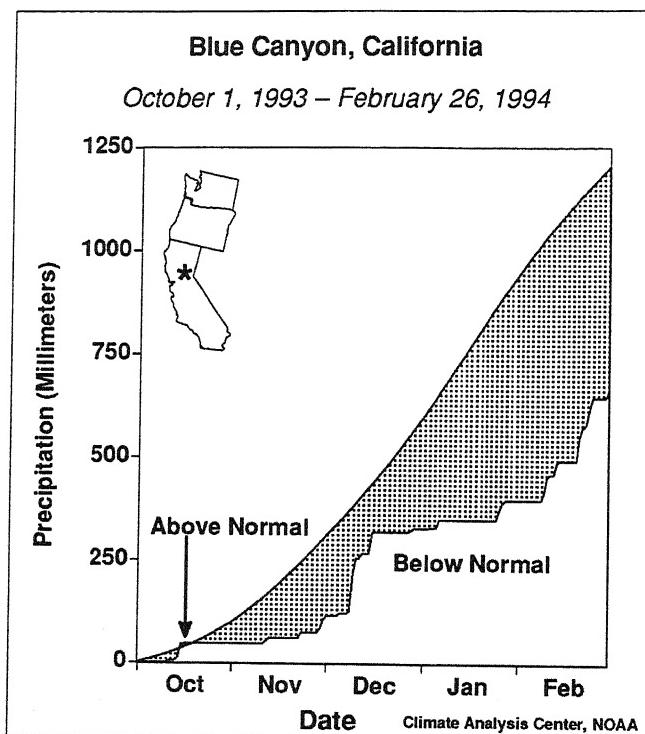
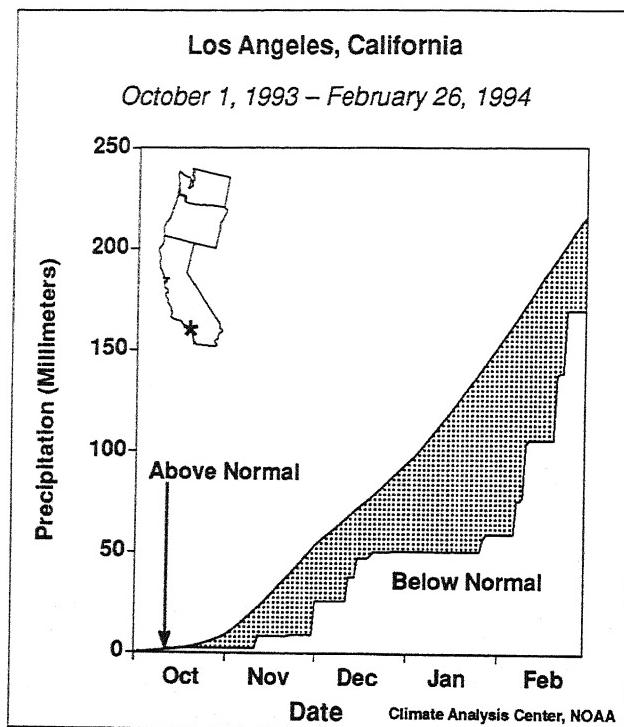
ton and adjacent southwestern British Columbia (see page 6). Deficits exceed 600 mm in the Washington Cascades and across parts of southwestern Vancouver Island. The highest totals were measures in the central and northern Sierra Nevadas, northwestern California, the southern Cascades, western Washington, and the Washington Cascades, where amounts of 800 – 1352 mm fell (see page 6). In stark contrast, under 50 mm of precipitation was reported in central and southern Nevada, southeastern California, western Arizona, and part of eastern Oregon. A graphical depiction of the season's deficits is shown for four locations on page 7. Note that although the relative size of the shortages differs markedly from location to location, the general pattern of consistently below normal precipitation is evident at each of these disparate points (and, in fact, throughout the region). Also note that precipitation generally increased during February, but not enough to eliminate the shortfalls. According to reports received from the SNOTEL network, above-normal seasonal precipitation was restricted to a few river basins in southeastern Oregon, central Wyoming, eastern Utah, central Colorado, and northern New Mexico (see page 8). Less than half of the normal snowpack was observed only at a few basins in southern New Mexico, but most basins throughout the region had only 50% – 80% of normal mountain snow water content by February 22.

Despite the subnormal rainy season, the melting of last season's exceptionally deep snowpack has pushed reservoir storages above those observed a year ago in nine of the eleven western states (see page 9). As of February 1 (before the recent heavy precipitation), California and Oregon's storages were near 100% of normal. Farther north, storages were only about 25% of normal in Washington, where precipitation was not as heavy in 1992–93. Furthermore, storages remained exceptionally low in Nevada, even though they doubled during the past year.

Page 10 depicts the percent of normal seasonal precipitation reported in each of California's ten hydrologic regions through January 1994 (February's increased precipitation likely boosted these numbers by 10% – 15%, but no official data are yet available). These totals are disquietingly similar to the numbers observed through the six "drought" seasons of 1986–87 through 1991–92; however, with ample reservoir storages, no significant water supply difficulties are anticipated this year.



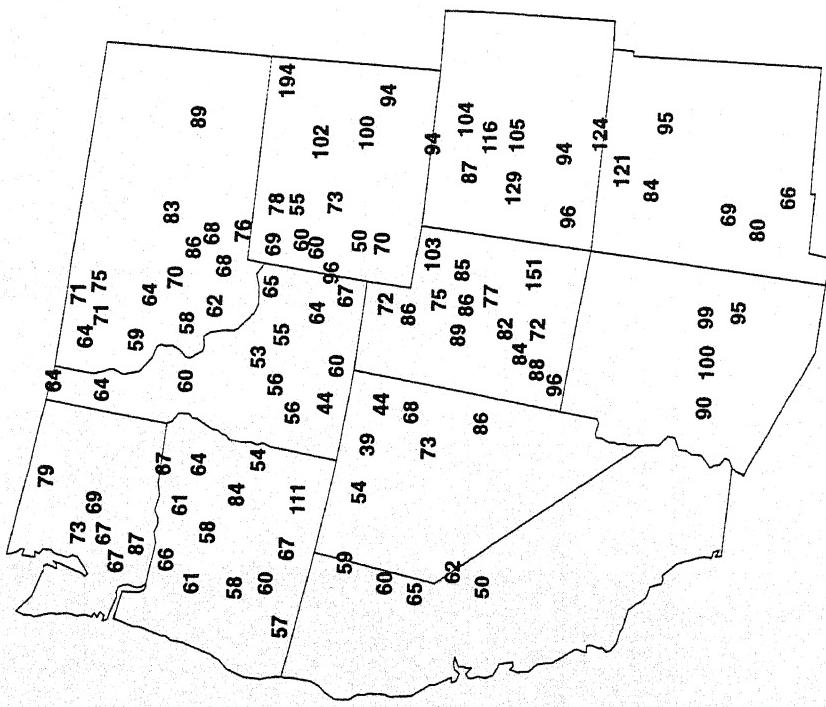
## DAILY CUMULATIVE PRECIPITATION



## SNOTEL PRECIPITATION PERCENT OF AVERAGE

## Basin Averages

*October 1, 1993 – February 22, 1994*

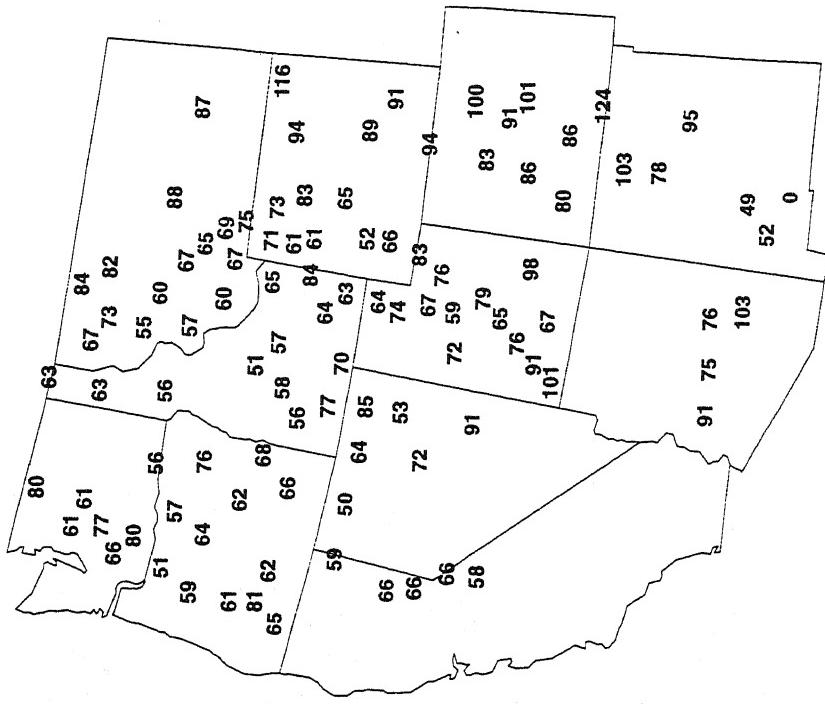


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## SNOTEL PERCENT OF AVERAGE SNOWPACK

Western Basins

*October 1, 1993 – February 22, 1994*

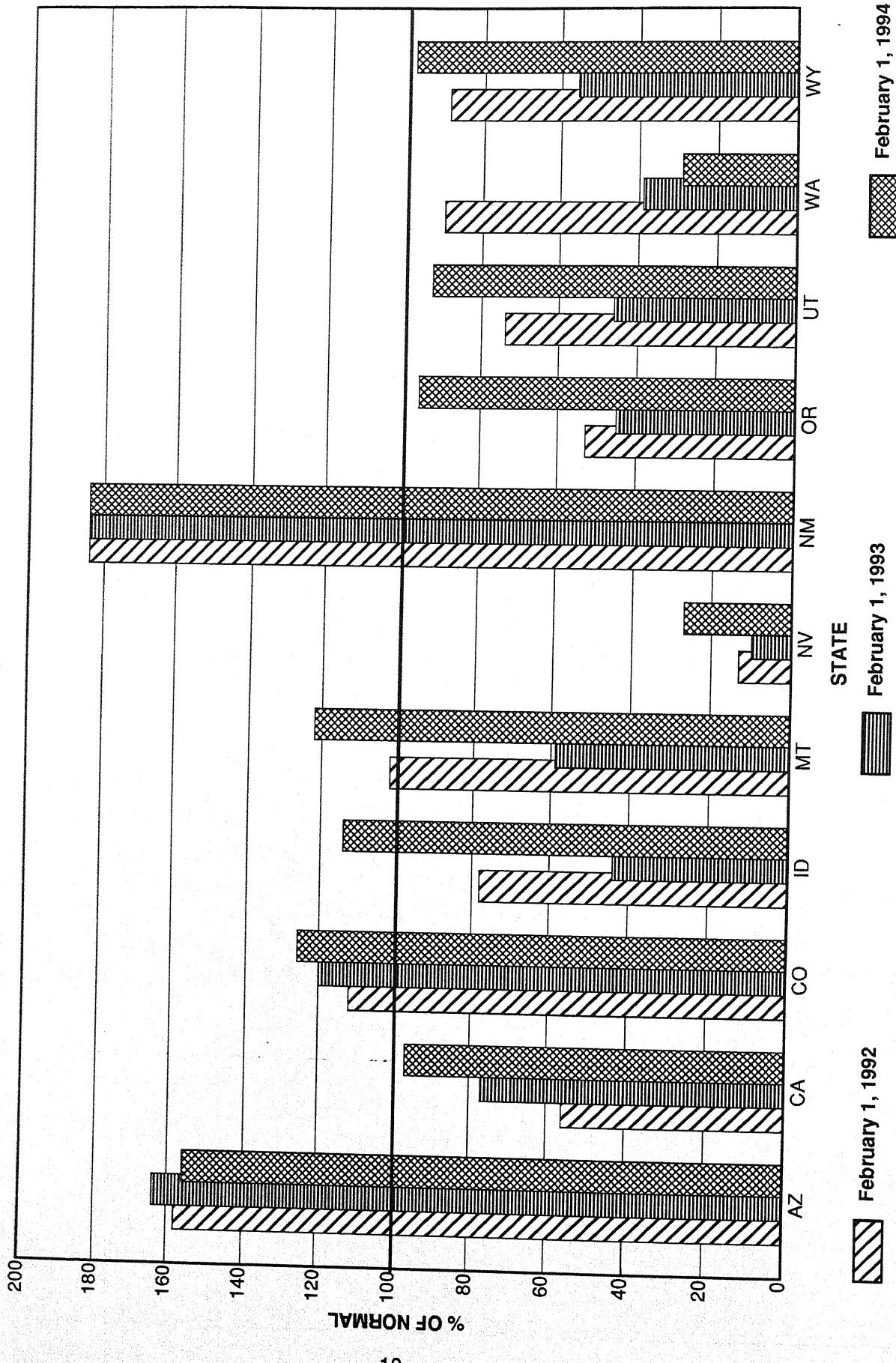


Western Regional Climate Center

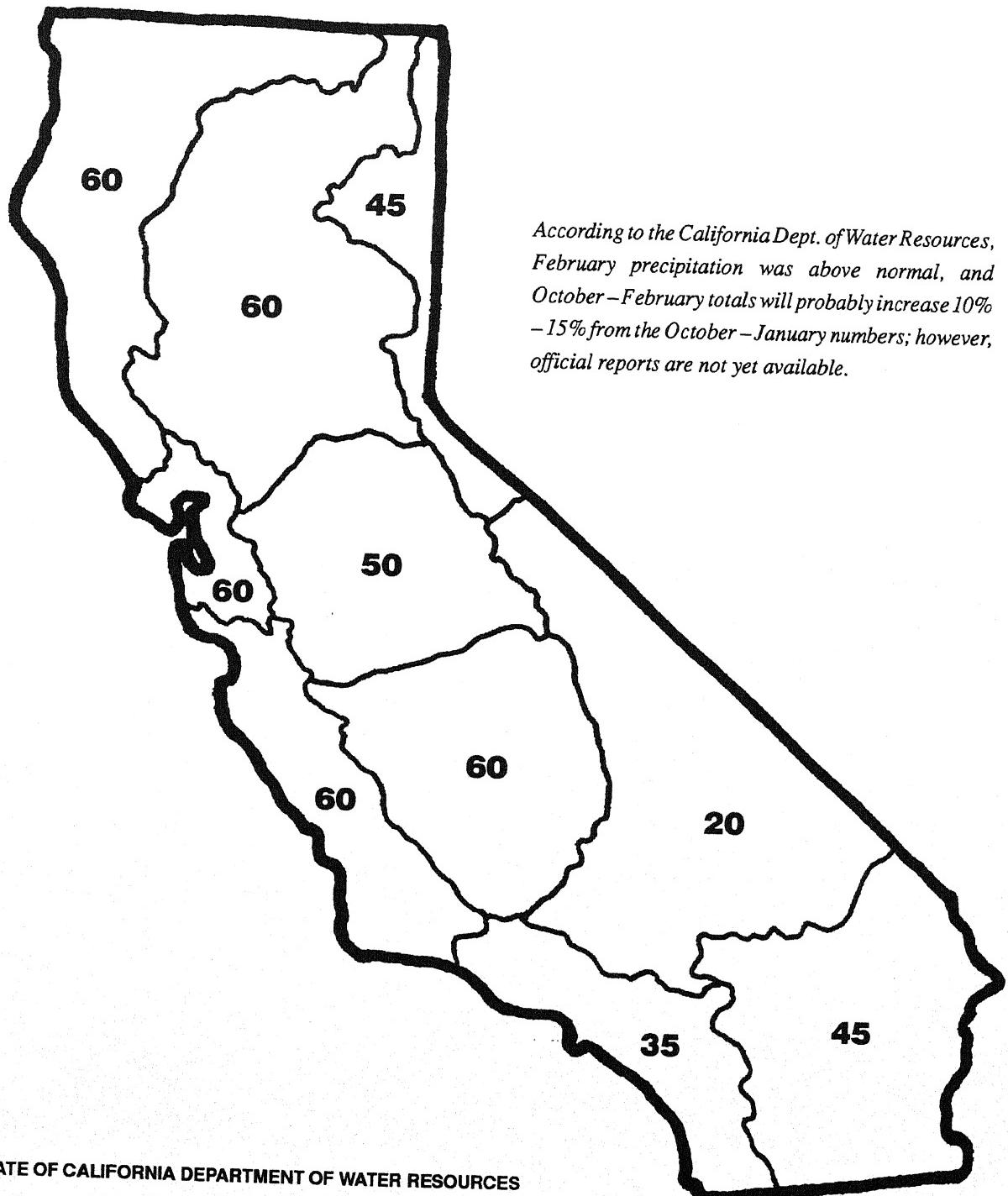
Western Regional Climate Center

## STATEWIDE RESERVOIR STORAGE AS A PERCENT OF NORMAL

As of February 1, 1992 – 1994



**PERCENT OF NORMAL PRECIPITATION BY HYDROLOGIC REGION**  
*October 1993 – January 1994*



STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES